Soybean Production Costs and Export Competitiveness in the United States, Brazil, and Argentina

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Abstract: Argentina and Brazil have become increasingly strong competitors to the United States in international soybean and soybean product markets, as evidenced by steady market share gains in recent decades. A comparison of combined marketing, transportation, and farm-level production costs in the late 1990s reveals that Brazil and Argentina maintained a competitive advantage over the United States in production costs, mainly due to higher imputed land values in the United States. The U.S. production cost disadvantage was partially offset by lower internal transportation and marketing costs, but Brazil and Argentina have reduced these costs considerably in recent years.

Key words: Brazil, Argentina, agriculture, soybeans, production costs, competitiveness.

Introduction

The competitiveness of U.S. agricultural products in export markets is an ongoing concern for domestic producers and U.S. policymakers. The United States has long been the world's leading exporter of soybeans, corn, and wheat, but it has faced increased competition from other exporters for global market share of these commodities.

This situation is exemplified by the declining share of U.S. soybean and product exports in global markets since 1980, despite increased domestic production and aggregate exports. For example, the U.S. share of global soybean and soymeal exports (in soybean equivalents) has declined from about 55 percent in 1980 to slightly over one-third in 2000, whereas Brazil and Argentina's combined share of global soy complex exports has grown from about 31 percent to nearly 50 percent (fig. A-1).[2]

Competitiveness in commodity markets of course reflects the influence of many different factors. These include relative resource endowments and agro-climatic conditions, but also the impact of macroeconomic policies (affecting exchange rates, work incentives, investment, energy costs and availability, etc.), sector-specific policies (e.g., credit subsidies, import or export taxes on inputs or final products), infrastructure (for storage and transportation), and supporting institutions (e.g., credit, regulatory, news and information, etc.) that help markets to work effectively. Export shares and growth trends also depend on domestic demand, relative returns to other crops, and other conditions.

However, in its simplest terms, international market competitiveness is the ability to deliver a product at the lowest cost—i.e., with the lowest combined farm-level production, transportation, and marketing costs. On this basis, analysis of 1998/99 cost structures underlying soybean production, transportation, and marketing from principal growing regions to a common export destination, Rotterdam, suggests that the United States lagged slightly behind Argentina and Brazil in soybean export cost competitiveness.

At the farm level, soybean producers in the U.S. 'Heartland' had the highest overall average costs of production at $5.11 per bushel, ranging from 18 to 25 percent above those of Argentine or Brazilian competitors.[3]

Total production costs were lowest in Argentina's central soybean growing region (southern Santa Fe and northern Buenos Aires Provinces) and in Brazil's interior expansion zone (the State of Mato Grosso), at about $3.90 per bushel in both regions (fig. A-2). Production costs in Brazil's coastal State of Parana (in its traditional agricultural heartland) were estimated at $4.16 per bushel. High imputed land costs in the United States account for much of the difference in overall production costs. The U.S. production cost disadvantage is partially mitigated by internal transportation and marketing cost savings. In Brazil and Argentina, these costs are two to three times higher, on average, than in the United States, despite important efficiency gains in recent years.

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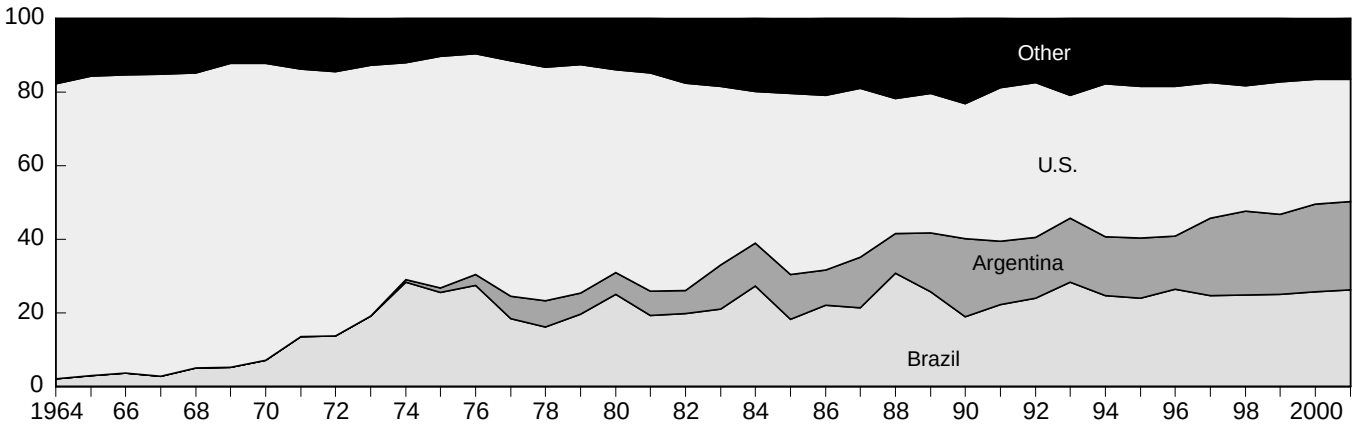
[2] The U.S. share of world corn exports fell from an average of 67 percent during 1980-89 to 61 percent during 1998-2000. The U.S. share of world wheat exports fell from an average of 34.3 percent during 1980-89 to 22.8 percent during 1998-2000. Source: USDA, PS&D database.

[3] The Heartland is defined as western Ohio, Indiana, Illinois, Iowa, northern Missouri, western Kentucky, and parts of Nebraska, Minnesota, and South Dakota.

Figure A-1

U.S. share of world soybean and soymeal market has steadily eroded*



*Soybeans and soymeal as soybean equivalents.

Source: USDA, Aug. 10, 2001.

Freight charges to Rotterdam are also higher from South America. As a result, the delivered cost of Argentine and Brazilian soybeans at Rotterdam ranged from 2 to 12 percent less than U.S. costs in 1998/99.

Methodology Behind the Cost Comparisons

The export cost competitiveness of U.S., Brazilian, and Argentine soybean producers is examined by comparing the components and distribution of farm-level production costs, the costs of internal marketing and transportation, and shipping costs to a common export destination. Cost data for each country were from local 1998/99 marketing years, the most recent year for which detailed comparisons were possible.

First, production costs were separated into their variable- and fixed-cost components. Variable costs include the use of inputs such as seed, fertilizer, chemicals, fuel, machine repair, interest on operating capital, and other direct costs incurred during crop production. Land costs—e.g., rental, maintenance, etc.—are not included with variable costs of production, but are combined with fixed production costs following Economic Research Service (ERS) methodology that uses land rental rates to value the opportunity cost of all land farmed. Fixed costs include costs that are not directly tied to the production decision, such as land payments on principal, interest and taxes, depreciation of machinery and equipment, and farm overhead.

Cost data from the U.S. Heartland region, where most U.S. soybean production takes place, were chosen to represent the United States. U.S. data are based on surveys by the National Agricultural Statistics Service (NASS), using the Agricultural Resource Management Study (ARMS). The data are compiled and published by ERS for regional and national aggregates.[4] For Brazil, data from USDA and Brazilian Government sources were compiled for two regions: the State of Parana, a leading soybean producer in the South; and Mato Grosso, the largest soybean producing State in the Center-West.

In Argentina, average variable cost-of-production data for northern Buenos Aires/southern Santa Fe (the heart of the corn-soybean region) were obtained from *Margenes Agropecuarios* (January 1999) based on no-till, Roundup Ready soybean production for high-yielding corn and soybean land. The lower end of the average yield range of 3.4 to 3.8 tons per hectare (50.6 to 56.5 bushels per acre) was used in the per-bushel cost calculations. Argentine land rents are also based on data from *Margenes Agropecuarios* (July 1999) for rental rates in the northern Buenos Aires production region. Other fixed cost data were adapted from Vieira and Williams (1996). A detailed and comparable breakdown of variable production costs for the Buenos Aires/Santa Fe region was not available, but the distribution of variable production costs based on suggested practices in the northern Province of Chaco was available, and is presented in table A-1 for comparison purposes.[5]

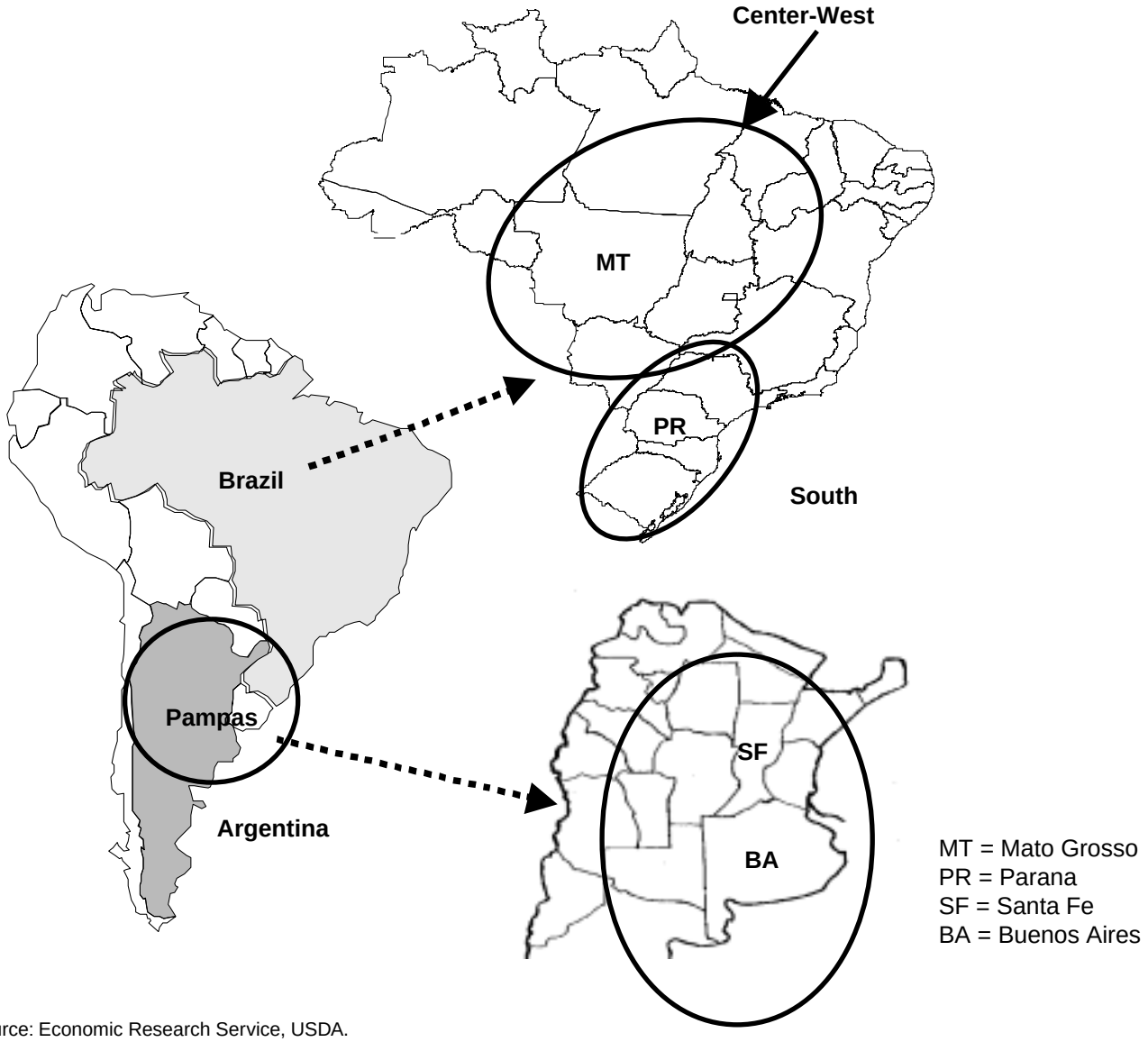
Internal marketing and transportation costs in the United States and Brazil are estimated by calculating the average

[4] For soybean cost-of-production data, see http://www.ers.usda.gov/data/costsandreturns/car/soybean2.htm.

[5] Chaco is primarily a cotton growing region, but soybean production has emerged there in the past decade. According to Hinrichsen (2001), 350,000 hectares of soybeans were planted in Chaco in 1999, making it the fifth leading soybean Province in Argentina, by area planted.

Figure A-2

Argentina's and Brazil's main agricultural production zones



Source: Economic Research Service, USDA.

monthly spread between farm-level soybean prices and the f.o.b. (free on board) port prices during calendar years 1998 and 1999. These spreads should reflect differences in transportation, storage, drying, loading and unloading, taxes, and other costs associated with bringing soybeans from farm to cargo vessel. Port prices are from the U.S. Gulf ports and the port of Rio Grande in Brazil.[6]

For Argentina, monthly farm-level prices were not available, so internal marketing and transportation costs were estimated in two steps. First, port and associated charges (including a 3-percent export tax) were estimated as the difference between f.o.b. port prices and f.a.s. (free alongside ship) Rosario terminal prices—reflecting port charges (loading, export tax, and quality control). Next, costs of bringing soybeans from farm to port were estimated using information from other sources on internal transportation charges at the average distance to port in 1998, plus estimates of other marketing costs (loading/unloading, and brokers' commission).[7]

[6] Although other major ports in Brazil (e.g., Santos and Paranagua) lie closer to the production regions in Parana and Mato Grosso, a consistent series of f.o.b. prices was available only for the port of Rio Grande. Nevertheless, f.o.b. prices for Rio Grande should be reflective of f.o.b. prices at other ports in Brazil's South since they all lie in relatively close proximity to oceangoing cargo vessels.

[7] Estimates of freight and other charges from farm to port are based on data from the Brazilian oilseed crushing association (ABIOVE), cited in Verheijden and Reca (1998), and data provided by the Argentine brokerage firm Cortina-Beruatto (Frogone, 2001).

Why compare costs?

In addition to providing an overview of current cost conditions in each country, cross-country comparisons of production and marketing costs can be a useful tool for decision-makers considering production, investment, or policy alternatives, and can help guide expectations of future market developments. For example, a country that can produce and transport a commodity to an export destination at lower cost would be expected to increase production and gain market share relative to its competitors, holding other factors equal. In addition, information on the contribution of particular cost components to total production and marketing costs can be used to interpret the impact of changing input prices on production incentives in different countries. A sustained rise in fuel prices, for instance, could have a greater negative impact on Brazilian soybean supply and export growth than in the U.S. or Argentina since the costs of transporting soybeans from production regions to ports are disproportionately large in Brazil, especially from the country's interior Center-West region. This is due to the greater reliance on road (truck) transportation to ports in Brazil than in the United States (where commodities are generally transported by barge), and greater average distances to port than in Argentina (average distance from farmgate to the Argentine port of Rosario is about 330 kilometers, compared with about 1,500 kilometers from Brazil's Center-West to Atlantic ports).

Similarly, natural gas prices may have a stronger impact on corn-soybean planting tradeoffs in the United States than Argentina since (natural-gas based) nitrogen fertilizers are more heavily used by U.S. corn producers. The contribution of internal transportation costs to final port prices can also inform policy-makers and private investors about the potential impacts of transportation infrastructure projects. Other investment decisions, such as the construction of new processing facilities, can be guided by information on the cost-competitiveness of production in different countries and regions within each country.

The third factor affecting the competitiveness of U.S. and South American soybeans in export markets is the cost of bringing the soybeans from the point of embarkation to their export destination. These costs are estimated by examining the average monthly spread between f.o.b. port prices and the c.i.f. (cost, insurance, and freight) price at a destination port, in this case Rotterdam, during 1995-99. The European Union is the world's largest importer of soybeans and soymeal—accounting for about 35 percent of global soybean imports and about 40 percent of soymeal imports during the 1998 and 1999 marketing years—and Rotterdam is the leading port of entry for these products.

Table A-1 summarizes the production cost data on a per-acre and per-bushel basis, and table A-2 presents estimates of the overall 'export cost' from the different production regions using a 'landed' soybean price in Rotterdam—calculated by adding the estimated shipping charges and internal marketing and transportation costs to the farm-level costs of production for each country.

The comparisons made here are only rough indicators of competitiveness. Comparisons of farm-level costs of production, in particular, are difficult and potentially imprecise for a number of reasons. For example, the methods used to calculate costs vary considerably from country to country, with certain components of cost included by one country and omitted by others. In addition, cost estimates may be based on different production practices (such as single- or double-cropping, till or no-till production) or slightly different time periods (based on local growing seasons). Estimates are further complicated by exchange rate conversion issues, differences in financial versus economic accounting, the impact of policy distortions, and the fact that data reflect production and marketing costs for regions that bear different relationships to national averages in their respective countries. Data presented here may not correspond exactly with source data due to certain assumptions and the omission or reformulation of some data to make them as comparable as possible.

Soybean Production Cost Structure Favors Argentina and Brazil

With their favorable natural resource endowments and climates, Argentina and Brazil are naturally low-cost producers of soybeans, giving them a strong competitive edge in international markets. Based on 1998 farm-level soybean production cost and yield data, total per-bushel costs in Brazil's Mato Grosso ($3.89 per bushel) and Argentina ($3.92 per bushel) were 23-24 percent lower than the U.S. Heartland's $5.11 total cost per bushel. Production costs in Parana ($4.16 per bushel) were 19 percent lower. Similarly, total per-acre soybean production costs were highest in the U.S. Heartland, averaging about $235, some $60-$70 more than in Brazil and about $35 an acre higher than in Argentina during 1998/99 (table A-1).[8]

The relatively high overall costs in the United States are attributable largely to high fixed costs of production, particularly the large imputed land costs faced by U.S. producers. This is especially true in comparison with Brazil, where estimated rental rates are just $6 (in Mato Grosso) to $14 (Parana) per acre, compared with $88 in the U.S. Heartland and $63 for prime land in northern Buenos Aires Province.

[8] Total per-acre soybean production costs in the Heartland are slightly above the U.S. national average, largely reflecting higher land costs, but higher yields led to somewhat lower (about $0.25/bushel) per-bushel costs of production than the national average. We exclude the opportunity cost of unpaid labor from the U.S. data. It is likely also excluded from Argentine and Brazilian data.

Table A-1--Soybean production costs: United States, Brazil, and Argentina, 1998/99

Cost item	U.S. Heartland 1/	Brazil 2/		Argentina	
		Parana	Mato Grosso	N. BA / S. SF 3/	Chaco 4/
			U.S. $ per acre		
Variable costs:					
Seed	19.77	16.69	11.23	n/a	17.90
Fertilizers	8.22	20.66	44.95	n/a	0.00
Chemicals	27.31	20.56	39.97	n/a	16.90
Machine operation/repair	20.19	26.88	18.22	n/a	24.00
Interest on capital	1.81	5.63	12.11	n/a	n/a
Hired labor	1.29	22.72	5.58	n/a	4.30
Harvest	n/a	n/a	n/a	n/a	22.24
Miscellaneous	n/a	2.00	n/a	n/a	n/a
Total variable costs	**78.59**	**115.14**	**132.06**	**96.29**	**85.34**
Fixed costs:					
Depreciation of machinery/equipment 5/	47.99	41.04	8.97	19.08	
Land costs (rental rate)	87.96	14.28	5.84	62.72	
Taxes and insurance	6.97	1.63	0.55	n/a	
Farm overhead 6/	13.40	n/a	n/a	20.67	
Total fixed costs	**156.32**	**56.95**	**30.01**	**102.47**	
Total production costs	**234.91**	**172.09**	**162.08**	**198.76**	
Yield (bushels/acre)	46.00	41.35	41.65	50.60	
Variable costs per bushel	1.71	2.78	3.17	1.90	
Fixed costs per bushel	3.40	1.38	0.72	2.02	
Total costs per bushel	**5.11**	**4.16**	**3.89**	**3.92**	

1/ U.S. data are from ERS, USDA; *http://www.ers.usda.gov/data/costsandreturns/car/soybean2.htm*. The U.S. marketing year is September 1998 to August 1999. Data presented here exclude opportunity cost of unpaid labor. 2/ Data for Parana are from USDA, FAS attache, *Annual Report 2000, Brazil: Oilseeds and Product* ("FAS-USDA 2000"), and from the Parana State Department of Agriculture (SEAB/DERAL). Data for Mato Grosso come from CONAB, GEAME, CUSTOS. Yield estimates are from FAS-USDA, 2000. Brazil's marketing year is February 1998 to January 1999. Producer price data are from the Fundacao Getulio Vargas, provided by CONAB. 3/ Variable costs are average direct plus harvest costs for no-till, Roundup Ready soybean production in northern Buenos Aires/southern Santa Fe based on assumed yield (Source: *Margenes Agropecuarios*, January 1999). Land cost data are based on northern Buenos Aires Province rates (Source: *Margenes Agropecuarios*, July 1999). Other fixed costs for Argentina are adapted from 1991 data from Vieira and Williams (1996) based on the assumption that these fixed costs increased at the Argentine rate of (CPI) inflation between 1991 and 1998. Argentina's marketing year is April 1998 to March 1999. The Argentine producer price is based on the difference between f.o.b. port prices (SAGPyA) in October 1998, and the estimated costs of internal transportation and marketing (ABIOVE data cited in Verheijden and Reca, 1998; and Frogone, 2001). 4/ Variable cost data for Chaco are based on suggested practices for conventional soybean planting techniques and are indicative of the relative importance of different inputs (Source: INTA, Argentine Ministry of Agriculture – SAGPyA). 5/ In addition to depreciation, the U.S. figure includes interest on nonland capital, which amounts to approximately one-fifth of the $47.99 total. 6/ For Argentina, this category includes maintenance on fixed capital.

The particularly low rental rates in Brazil's Center-West reflect the abundance of cerrado soils still available for conversion into agricultural production. Recent reports indicate that high yielding land in Mato Grosso can still be purchased for as little as $200 an acre, compared with over $2,000 per acre in the U.S. Corn Belt.

Differences in land costs clearly play a crucial role in assessments of competitiveness based on overall production costs. For example, if land costs are excluded from overall production costs, the United States would rank ahead of Brazil, but still behind Argentina, in production-cost competitiveness.[9]

Based on variable costs alone, soybean growers in the U.S. Heartland are the low-cost producers. In Parana, greater fertilizer and labor costs (due to small-scale and labor-intensive production practices) inflate variable costs. In Mato Grosso, higher fertilizer and chemical costs (due most likely to higher prices rather than greater intensity of application) keep variable costs high.

Low expenditures on lime or fertilizers keep Argentine variable costs closer to U.S. costs. A previous ERS study (Trapido and Krajewski, 1989) also showed that the main Argentine producing Provinces (Buenos Aires and Santa Fe) had slightly higher variable costs per ton of production than the U.S. Corn Belt/Lake States, but another study (Ortmann et al., 1989) calculated per-ton variable costs to be slightly lower in Argentina.

Also favoring soybean farms in Argentina and Brazil's Mato Grosso are their much larger size (averaging over 1,000 hectares) relative to soybean farms in the U.S. Heartland (120-150 hectares), or Brazil's Parana (about 30 hectares)—where land is scarcer and a large class of landless or near-

[9] Previous studies (Ortmann et al., 1989; Vieira and Williams, 1996) show similar results.

landless labor exists. Large farm size spreads overhead costs over more acres, resulting in much lower per-unit costs. As a result, average depreciation of machinery and equipment costs were significantly lower in Mato Grosso and Argentina than in the United States.

The United States had higher soybean production costs than Parana throughout the 1990s. U.S. average soybean costs rose steadily from $185 per acre in 1989 to $235 per acre in 1998, slightly below the general pace of consumer inflation.[10] The increase was due mainly to rising fixed costs, particularly land. Increased chemical costs were responsible for a slight growth in variable costs.

However, fluctuations in the Brazilian currency render U.S. dollar-valued representations somewhat misleading. For example, in dollar terms, costs of production in Parana have fluctuated considerably in the last 10 years. After declining sharply from $256 per acre in 1989 to $134 in 1991, total costs of production rose again to $169 per acre in 1992. Production costs ranged between $158 per acre and $205 per acre during 1993-98, before falling to a decade low of $129 per acre in 1999 (according to just recently available data).

In local currency terms, however, total production costs in Parana rose nearly 30 percent between 1995 and 1999, so the apparent decline is largely a reflection of the weakening Brazilian currency, particularly after the real was allowed to float freely in international exchange markets. In Mato Grosso, most of the increase in total production costs between 1991 and 1998 (from $99 to $162 per acre) was due to higher chemical costs and interest on operating capital. Limited data from Argentina suggest that soybean producers there have had lower farm costs than U.S. producers throughout the 1990s.

Internal Marketing and Transportation Costs are Lowest for United States

The Brazilian and Argentine advantage in farm-level production costs is largely offset by much higher internal marketing and transportation costs. However, significant reductions in these costs since 1992 in Argentina and after 1996 in Brazil have boosted their soybean export competitiveness in recent years.

During 1998-99, internal marketing and transportation costs for soybeans destined for export averaged two to three times higher in Brazil and Argentina than in the United States, tending to dampen farmgate prices. Based on average farm-to-port distances, these costs averaged $49 per metric ton ($1.33/bushel) from Mato Grosso, $31 per ton from Parana, and $30 per ton for Argentine producers. In the United States, these costs amounted to just $16 per ton. For producers in Mato Grosso, transportation and marketing costs were equivalent to one-quarter of the average f.o.b. port price during 1998.

These figures correspond with the combined freight-to-port and port charges estimated by ABIOVE (Brazilian vegetable oil industry association) for each country. According to ABIOVE, at the average distance to port, these charges totaled $18 per ton for the United States and $25 per ton in Argentina (including export taxes but not a broker's commission of $2-$5 per ton) in 1998. For Brazil, these charges were estimated at $41 per ton.

Since the mid-1980s, the average U.S. producer-to-f.o.b. port price spread has remained relatively constant at $16-$18 per ton. In Argentina and Brazil, however, privatization and deregulation of railways and ports, and the elimination or reduction of export controls have lowered transportation and marketing costs in recent years.

In Argentina, the margin between the terminal cash price at Rosario and the f.o.b. price of soybeans at Argentine ports has narrowed from an average of $68 per metric ton during 1980-91, to just $11 per ton since 1991. Nevertheless, farmgate-to-terminal transportation costs remain high due to a heavy reliance on trucking for bulk transport, high toll rates on private highways, and seasonal transportation bottlenecks.

In Brazil, similar internal cost reductions may have resulted in part from transportation infrastructure improvements, but also reflect the elimination (through rebates) of a 13-percent value-added tax on soybean exports in 1996. For Mato Grosso producers, whose soybeans must traverse roughly 1,500 kilometers to reach an east coast seaport, the producer-f.o.b. price spread averaged $76 per ton from 1983 to 1997. Since 1997, they have averaged an estimated $47 per ton. In Parana, where soybeans have a much shorter distance to oceangoing vessels, substantial internal cost reductions have also occurred as the producer-f.o.b. price spread has fallen from an average of $52 per ton during 1983-97 to $29 since 1997 (fig. A-3).

Lower transport and marketing costs for the United States reflect, in part, the efficient barge transportation system that can transport grains long distances at low cost. In Argentina and Parana, the fact that most soybean production takes place within 250-300 kilometers of ports has kept their costs significantly below those of Mato Grosso.

Shipping Charges to Rotterdam Favor United States

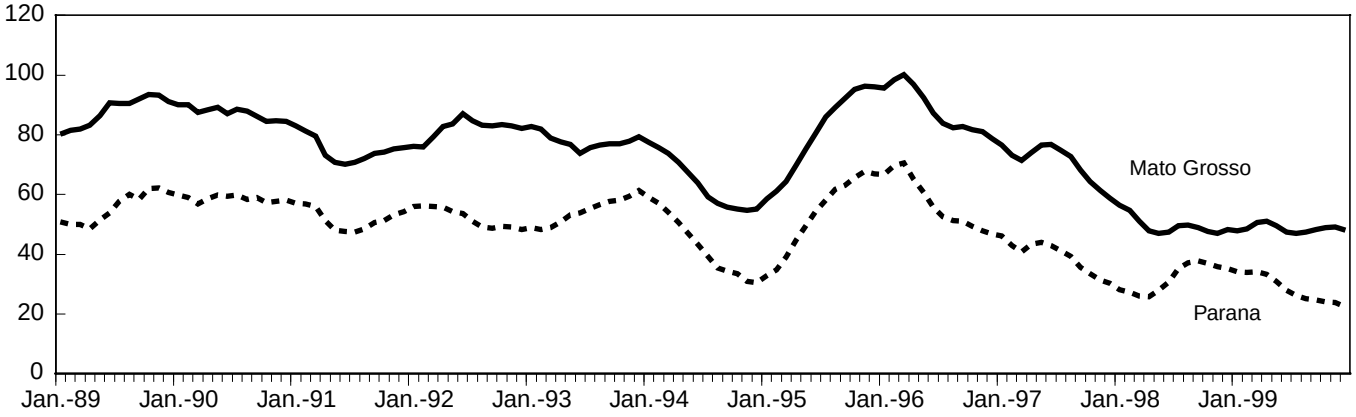
The United States has a small advantage ($0.11 per bushel) over Argentina and a somewhat larger one over Brazil ($0.19 per bushel) in shipping charges to Rotterdam. This further narrows the export cost differentials when the combined production, marketing, and transportation costs are compared at the import destination of Rotterdam (table A-2).

[10] U.S. data prior to 1997 are for the North Central region, and for the newly defined Heartland in 1997 and 1998.

Figure A-3

Brazil port-to-farmgate soybean price differences are declining as infrastructure develops*

U.S. $ per metric tons



*12-month moving average (monthly f.o.b. port prices minus farm price).

Source: farm prices, Getulio Vargas Foundation Brazil; f.o.b. port prices (Rio Grande do Sul), *Oil World Weekly*.

The difference between the f.o.b. export price and c.i.f. import price spreads for the United States and South American countries is mostly attributable to distance (to Rotterdam), but may also reflect higher insurance rates and demurrage costs for ships originating from South American ports. With even greater relative distances to East Asian ports (e.g., Japan, South Korea, and China), Brazilian and Argentine soybean exports face a larger disadvantage (compared with the United States) in shipping rates to these destinations.

The gap between shipping rates from the United States and Brazil to Rotterdam has remained relatively constant over the last 15 years. But for Argentina, the average f.o.b.-to-c.i.f. price spread has narrowed from $26 per ton during 1984-94 to $18 per ton during 1995-99.

Producer Revenues

With substantially higher total costs of production and similar yields, per-bushel and per-acre net revenues based strictly on a market price (ignoring LDPs, production flexibility contract payments, emergency supplementary income payments, and subsidized crop insurance) for U.S. Heartland soybean producers fall short of those for producers in Brazil and Argentina, assuming similar producer prices. However, higher internal transportation and marketing costs have depressed Brazilian producer prices to levels below those in the United States. In October 1998, producer prices of $4.81/bushel in Parana and $4.58/bushel in Mato Grosso lagged the $5.16/bushel received (excluding LDPs) in the U.S. Heartland. In Argentina, average producer prices were estimated at $4.98/bushel in October 1998.[11]

Nevertheless, in 1998, estimated per-bushel and per-acre net producer returns in Argentina were the highest among the three countries, followed by Brazil and the United States. Argentine producers received an estimated $1.06/bushel in 1998, compared with $0.69/bushel in Mato Grosso, $0.65/bushel in Parana, and just $0.05/bushel in the U.S. Heartland.[12]

Despite relatively low market-based returns in 1998 and consistently higher costs of production in the United States than in Brazil, estimated per-acre net revenues from soybean production in the United States have actually exceeded those of producers in Parana over much of the past decade (fig. A-4). Between 1989 and 1996, per-acre net returns in Parana exceeded those of U.S. North Central/Heartland soybean producers only once, in 1991. From 1997 to 1999, however, net revenues in Parana surpassed those in the United States, and were especially strong in 1998.[13]

[11] Argentine producer prices were based on the difference between actual October 1998 f.o.b. prices ($213/ton) and the estimated costs of internal marketing and transportation ($30/ton).

[12] The net revenue figure of 5 cents per bushel for U.S. Heartland producers is based on market prices only and does not include potential extra revenue from marketing loan benefits. When prices are below the loan rate, U.S. producers can realize gross revenues above the loan rate of $5.26 per bushel by receiving benefits under the marketing loan program early in the market year when prices are typically lowest, and then by selling their crop later in the marketing year when prices have risen. In the 1998 marketing year, for example, the weighted average marketing loan benefit (marketing loan gains and loan deficiency payments) for the soybean crop was $0.44 per bushel. This benefit augmented the season-average price of $4.93 per bushel, raising the average per-unit gross revenue for soybeans to $5.37 per bushel, $0.11 above the national soybean loan rate.

[13] The trend comparisons made here are based on local harvest-period prices, rather than adjusting prices to the same month (October 1998) as done elsewhere in this analysis. In the U.S., average producer prices are from October; average March-May producer prices were used for Brazil. For the U.S., data prior to 1997 are for the North Central region, and for the newly defined Heartland in 1997, 1998, and recently available 1999 data.

Table A-2--Hypothetical assessment of "export cost competitiveness," 1998/99

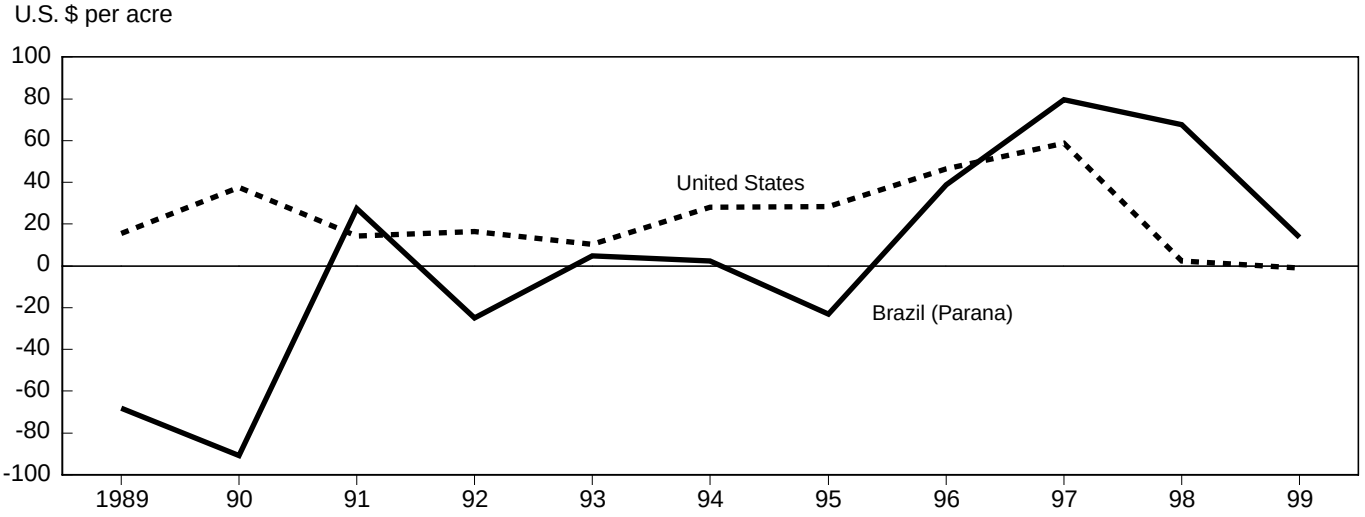
Cost item	U.S. Heartland	Brazil				Argentina	
		Parana		Mato Grosso		Buenos Aires / Santa Fe	
	$/bu.	$/bu.	% of U.S. cost	$/bu.	% of U.S. cost	$/bu.	% of U.S. cost
Production costs 1/							
Variable costs	1.71	2.78		3.17		1.90	
Fixed costs	3.40	1.38		0.72		2.02	
Total production costs	**5.11**	**4.16**	**81**	**3.89**	**76**	**3.92**	**77**
Internal transport & marketing 2/	0.43	0.85		1.34		0.81	
Cost at border	**5.54**	**5.01**	**90**	**5.23**	**94**	**4.73**	**85**
Freight costs to Rotterdam 3/	0.38	0.57		0.57		0.49	
Price at Rotterdam	**5.92**	**5.58**	**94**	**5.80**	**98**	**5.22**	**88**

1/ Variable and fixed costs in each country are based on local marketing year costs in 1998/99 (see table A-1). 2/ Internal transport and marketing charges for Argentina are estimated as the sum of port charges [the spread between f.o.b. and free-alongside-ship (f.a.s.) Rosario prices] and estimated transportation and other marketing costs. For Brazil, internal marketing and transportation costs are the average spread between farm prices and f.o.b. port prices during calendar years 1998 and 1999. 3/ Freight costs are calculated as the average spread between f.o.b. port prices for each country and the c.i.f. port price in Rotterdam during calendar years 1995-99.

Sources: c.i.f. Rotterdam prices (*Oil World Weekly)*; U.S. f.o.b Gulf Port prices (AMS, USDA); Rosario f.o.b. and f.a.s. port prices (Argentine Ministry of Agriculture, SAGPyA; Rio Grande (Brazil) f.o.b. port prices (Safras & Mercado); U.S. farm prices received (NASS, USDA); producer prices in Parana and Mato Grosso (CONAB); Argentine transportation and internal marketing costs to port: Verheijden and Reca (1998) and Frogone (2001).

Figure A-4

Net farm revenues per acre of soybean production: United States and Brazil*



Source: USDA; CONAB; authors' calculations, see footnote 13 on page 22.

Reduced internal transportation and marketing costs, as well as declining production costs (in dollar terms), have seemingly improved the bottom line for Brazilian producers since 1996. From limited data, it appears that net revenues in Mato Grosso have equaled or exceeded those in Parana during the 1990s, which is consistent with the trend toward increased production (and economies of scale) in that region.

Conclusion: Argentina was Most Competitive

Both Argentine and Brazilian soybeans have become more competitive in recent years due to declining internal marketing and transportation costs, including the reduction/elimination of export taxes on soybeans. Brazilian soybeans have also benefited from substantial currency depreciation since 1999.

In 1998/99, the underlying cost structures for producing, transporting, and marketing soybeans from Argentina's southern Santa Fe/northern Buenos Aires region and Brazil's two principal growing areas allowed them to bring soybeans to Rotterdam at prices slightly below U.S. soybeans grown in the Corn Belt. These cost advantages help explain the rapid expansion of soybean production and soybean/product exports by Argentina and Brazil during the last decade.

In the future, increased soybean plantings by Argentina, holding other factors constant, may be restrained by limitations on the ability to expand total area devoted to agricultural production. In contrast, increased soybean production in Brazil's Center-West (e.g., Mato Grosso) appears especially promising, given abundant, inexpensive land available for cultivation.

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